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STORAGE OF SOUTHERN-GROWN POTATOES DURING THE SUMMER

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Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Meridian, Miss.

INTRODUCTION

Potatoes are generally grown in the south as a spring crop. Since they are harvested about 90 days after planting, they are marketed before they are fully mature. Probably the most important reason for harvesting potatoes in this immature state is that the price generally drops as the season progresses. Another reason for harvesting early in much of the south is that if the potatoes are left in the ground too long they are subject to decay both in the field and after harvest, caused by *Sclerotium rolfsii* (6). In addition some other crop usually follows potatoes and there is often a desire to remove the potatoes to make way for the succeeding crop.

Immediately after the shipping season from the south ends, it is necessary to ship in potatoes from more northern points. Often southern potatoes are sold at very low prices and later, when potatoes are shipped in from the north, prices become much higher.

Many cold storage locker plants which have been built for the freezing preservation of foods have non-freezing rooms maintained at 32° F., or above, that can be utilized for storing fruits and vegetables in a non-frozen condition.

[1]Physiologist.

The experiments reported herein were conducted to determine the possibilities of various methods of storing southern-grown potatoes harvested in the spring or early summer,

Review of Literature

Practically all of the experimental storage work reported in the literature has been on late-crop potatoes which are generally harvested in a more or less mature condition. Only recently has there been work reported on storing early-crop potatoes.

Cordner (2), working in Oklahoma, found that in cellar storage, potatoes held up as long as the temperature remained in the low seventies but that decay developed quite rapidly when the cellar temperature reached 80° F. He reported that at 50° there is practically no decay, and shrinkage is held to a low rate. He recommends a curing period ranging from 10 days to 2 weeks in a cellar at a moderate temperature (about 70°) and in a moist atmosphere before placing them in refrigerated storage. Kimbrough (5) also recommends curing for one to two weeks before cold storage at 35° to 40°, in the case of Louisiana-grown potatoes. He found a storage temperature of 40° superior to 35°.

Materials and Methods

The experiments reported herein were conducted in 1941, 1942, and 1944 at the U. S. Horticultural Field Station, Meridian, Mississippi, with the Bliss Triumph variety. In 1941 the potatoes were harvested on the 4th of June at Columbia, Mississippi. In 1942 and 1944 the potatoes were obtained near Meridian, Mississippi, and were harvested on the 24th of June in 1942 and the 9th of June in 1944. The storage experiments were started the day after digging. The growing season was dry in 1941, wet in 1942, and about normal in 1944. There were some enlarged lenticels on the potatoes in 1942 but those that were especially bad were discarded prior to storage.

Four half-bushel baskets of potatoes were used for each treatment each of the first two years, and three baskets in 1944. Those in non-refrigerated storage were examined after 2½ months. Two baskets of each treatment in refrigerated storage were inspected after 2½ months' storage and the remaining two after five months' storage.

The five storage conditions used in 1941 and 1942 together with the temperature and humidity of each are given in table 1. The basement storage was kept as cool as possible by opening the doors and ventilators at night and closing them during the day. For each storage condition there was a non-cured lot as well as one lot cured one week

at 60° F. and another cured one week in a shed (average temperature — 81.1°) prior to storage.

TABLE 1.—*Temperature and humidity in various storage conditions.* (1941 *and* 1942.)

Storage Conditions	Temperature			Relative Humidity		
	Ave.	Min.	Max.	Ave.	Min.	Max.
	°F	°F	°F	Per cent	Per cent	Per cent
Shed	81.1	69.0	94.0	72.2	35	96
Basement	78.0	66.0	89.0	81.0	49	91
60°F	60.1	58.5	70.0	81.6	71	94
50°F	50.4	48.5	69.0	79.3	62	95
40°F	40.3	38.5	59.0	80.4	63	97

The differences required for significance between treatments were determined by the analysis of variance method.

The quality was determined by baking a sample of five potatoes from each treatment. The sugar content was determined on alcohol-preserved samples by the Quisumbing-Thomas method, the cuprous oxide being determined by the volumetric permanganate method. A representative portion of each of 25 tubers was taken for a sample.

RESULTS

Decay and Weight Loss in Non-Refrigerated Storage

Weight loss and decay were very high in both the shed and basement storage, as in shown in table 2.

TABLE 2.—*Percentage decay and loss in weight after 2½ months under non-refrigerated storage conditions.* (1941 *and* 1942.)

Curing	Percentage Decay at Storage Method Indicated		Loss in Weight at Storage Method Indicated	
	Shed	Basement	Shed	Basement
	Per cent	Per cent	Per cent	Per cent
None	35.0	35.5	19.6	12.6
60°F—1 week	29.3	32.1	15.7	10.8
Shed—1 week	—	25.7	—	10.8

Difference required for significance between treatments: Decay—6.7 per cent. Loss in weight—2.5 per cent.

From these results it is evident that losses would be too high to warrant storage of Bliss Triumph potatoes for as long as 2½ months during the summer under conditions such as prevail at Meridian, Mississippi, at room temperatures averaging about 81° or even in a basement storage averaging 78°. LeClerg (4) suggests that since the Katahdin, which is a white-skinned potato, keeps well in storage, growers should find this variety well adapted for supplying the local and southern market after the early shipping season is completed. Kimbrough (6) also found that the Katahdin keeps much better in common storage than the Triumph.

There have been some reports of potatoes keeping during the summer months under non-refrigerated conditions if they are spread out in a single layer and stored in a shed or under a house. There have also been reports of potatoes keeping well if sprinkled with hydrated lime. In order to determine the value of these methods, the following treatments were used in 1944:

1. Check—in basket.
2. Potatoes spread out in a single layer.
3. Potatoes in basket; ½ pound hydrated lime sprinkled on top of potatoes.
4. Same as 3 but entire surface of all potatoes covered with lime.

After storage in a basement for approximately 2½ months there was essentially the same percentage decay in all treatments,—averaging about 15 per cent.

Decay and Weight Loss in Cold Storage—Weight loss and decay in storage and decay during a one week's holding period at room temperature after removal from storage are given in table 3.

The greatest weight loss occurred in the potatoes stored in 40° F. without curing, whereas the least loss occurred in potatoes stored at this temperature for 2½ months after being cured at 60° F. for one week. The skinned areas on more than one-half of the tubers stored without curing became sunken and dark (Figure 1). These skinned areas failed to suberize and consequently continued to lose moisture throughout the storage period. None of this injury was present on potatoes stored at a higher temperature and practically none in those cured for one week prior to 40° F. storage. Artswager (1) has shown that healing of cut surfaces of potatoes occurs very slowly at low temperatures, especially below 50°, but at higher temperatures this healing, which involves suberization and wound periderm formation, takes place quite readily.

In order to determine the influence of length of curing necessary to prevent this injury, a lot of potatoes was subdivided into 7 sub-lots

TABLE 3.—*Weight loss and decay of potatoes stored in cold storage.* (1941 *and* 1942.)

Storage Temperature	Curing	Weight Loss		Decay in Storage		Decay During 1 Week Holding at Room Teemperature after Removal from Storage	
		2-½ Months' Storage	5 Months' Storage	2-½ Months' Storage	5 Months' Storage	2-½ Months' Storage	5 Months' Storage
°F		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
60	None	7.1	13.0	1.6	2.0	0	0
	Shed—1 week	7.8	14.2	2.4	6.5	1.0	0
50	None	7.9	11.6	1.2	2.2	0.4	0
	Shed—1 week	7.6	10.6	0.7	2.4	0.4	0
	60°F.—1 week	6.6	10.8	0	1.0	0	0
40	None	10.7	15.1	3.2	6.6	10.9	3.5
	Shed—1 week	6.8	8.3	0.7	0.4	0.3	0
	60°F.—1 week	5.9	9.3	0.6	0.7	0.3	1.0

Difference between treatments required for significance: Weight loss—1.6
Decay in Storage—Differences not significant.
Decay during 1 week of holding—4.4.

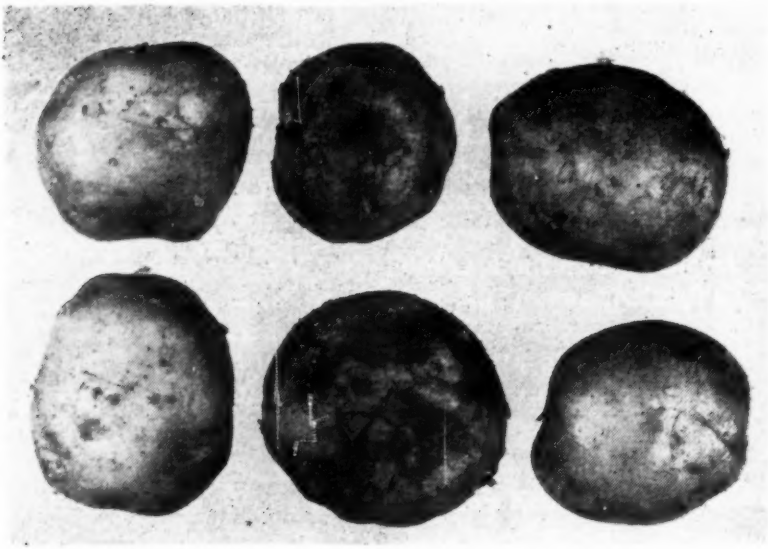

FIGURE 1.—Potatoes stored 2-½ months followed by one week at room temperature.

Not Cured	Not Cured	Cured 1 week at 60° F.
Stored at 50° F.	Stored at 40° F.	Stored at 40° F.

in 1942. These were cured 0, 1, 2, 4, 7, 11, and 14 days in a shed. When examined after 2½ months' storage at 40° F., it was found that potatoes cured for one day had about one-half as much injury as those not cured, and the potatoes cured two days showed about one-fourth as much, whereas those cured four days or longer were practically free from injury.

Decay in cold storage was not great in any of the treatments, but during a one week's holding period after being held 2½ months in storage the potatoes that were stored at 40° F. without curing developed a significantly higher percentage of decay than any of the others. This decay developed in the sunken discolored areas mentioned above.

The studies reported herein were made on potatoes of good quality. Parsons (7), working with early-crop Kansas potatoes, reported that deterioration and shrinkage were severe in cold storage where decay and sun damage were among the defects.

Influence of Storage Method on Sprouting, Shriveling and Color—It can be noted in table 4 that sprouting was held in check at 50° F. for 2½ months and at 40° for five months although some sprouts were emerging at 40° after five months' storage. Wright and Peacock (9) found a tendency toward a shortening of the rest period as the storage temperature was increased.

TABLE 4.—*Influence of lengths and method of storage on sprouting, shriveling and skin color.* (1941 *and* 1942.)

Storage Method	Sprouting after Storage Period Indicated		Condition after Storage Period Indicated		Skin Color after Storage Period Indicated	
	2-½ Months	5 Months	2-½ Months	5 Months	2-½ Months	5 Months
Shed	Starting—Sprouts ⅛ to 1 inch long	—	Somewhat shriveled	—	Considerably faded	
Root Storage	do	—	do	—	do	
60°F.	do	Sprouts 1 to 2 inches long	Slightly shriveled. Some turgidity lost.	Badly shriveled and spongy	Somewhat faded	Badly faded
50°F.	None	Sprouts emerging to 1 inch long.	Excellent[1]	Still marketable but somewhat shriveled	Good	Somewhat faded
40°F.	None	Generally none. Some emerging.	Excellent[2]	Excellent[3]	Good	Good

[1]Slight shriveling in non-cured potatoes stored at 50° F. after 1 week at room temperature.
[2]Non-cured potatoes stored 2½ months at 40° F. were somewhat shriveled.
[3]Non-cured potatoes stored 5 months were badly shriveled and spongy.

In these experiments the tubers were kept free from shriveling for 2½ months at 50° F., and for five months in the cured lots stored at 40°. The skin color remained free from visible fading for 2½ months at 50° and for five months at 40°.

Quality

The flavor of potatoes stored 2½ months under non-refrigerated storage conditions was generally satisfactory although in some cases it was slightly stale or aged. The flesh color was slightly yellowish especially in the case of those stored in the shed. In 1941 it was noted that some of the potatoes stored at these high temperatures was slightly hard.

After 2½ months' storage at 60° F. flesh color and flavor were good in 1941, but there was a trace of yellowing in 1942. A little sogginess was noted in 1941. After 2½ months' storage at 50°, flesh color, texture, and flavor were good. After storage at 40° for this length of time, the flesh color was good and the texture was generally good but was somewhat waxy in 1942. The flavor was decidedly sweet in the non-cured lot stored at this temperature. The cured lot, although somewhat sweet, had less sweetness than the non-cured lot.

After five months' storage at 60° F. the flesh color was slightly yellowish and the texture and flavor fairly good. Storage at 50° F. for five months resulted in potatoes that were of good color and flavor but only of fairly good texture. Potatoes stored five months at 40° had a good color but were somewhat soggy and the sweetness apparently remained unchanged during the interval since the examination after 2½ months.

There was practically no change in flesh color, texture, and flavor during a one week's holding period after removal from storage except that in the lot stored at 40° F. some of the sweetness disappeared. Although there was still some sweetness in the cured lots stored at 40° after they had been held for one week at room temperature, it was not particularly objectionable.

The influence of storage temperature on carbohydrate composition and its influence on quality has been investigated by Wright *et al.* (10). Potatoes stored at 36° to 40° F. were only fair in quality when steamed, boiled, or baked. When made into French fries, potatoes stored at 40° or lower were considered not edible. For potato chips, only those stored at 60° to 70° were considered desirable. Denny and Thornton (3) have shown that the color of potato chips is related to the reducing sugar content of the potatoes from which they are made. They found marked differences between varieties in their susceptibility

to sweetening at low temperatures. Bliss Triumph was one of the varieties that tended to have a very high reducing sugar content when stored at low temperatures.

Influence of Storage Temperature on Sugar Content

The total sugar content and the reducing sugar content of potatoes after 2½ and five months' storage, together with the sugar content after a week's holding period at room temperatures subsequent to removal from storage, are given in figures 2 and 3. The sugar content was much greater in potatoes stored at 40° F. than in those stored at

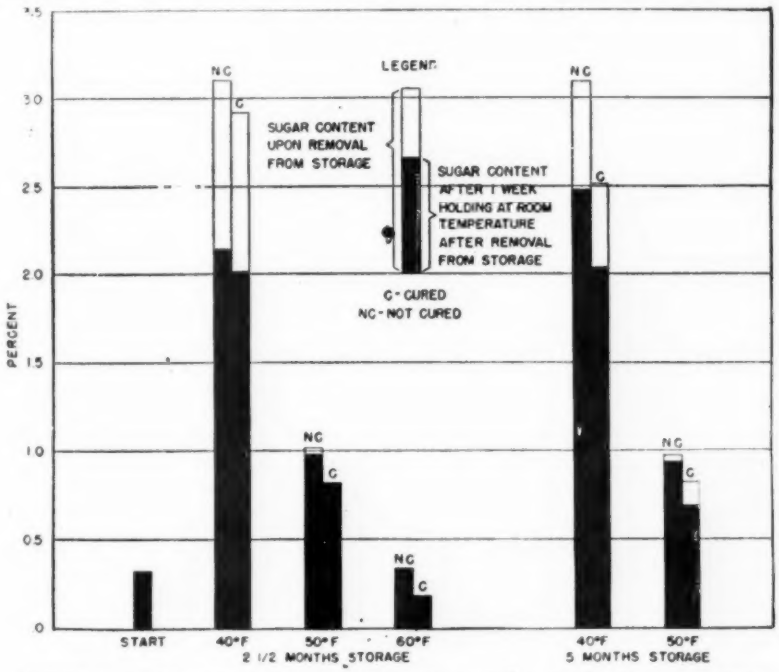

Figure 2.—Total sugar content of potatoes stored at various temperatures.

higher temperatures. There was less sugar in the cured lots stored at 40° than in those not cured. The sugar content decreased in potatoes with high sugar content during the one week's holding period after removal from storage. This is in accord with the recommendation of Rose, Wright, and Whiteman (8) who suggest a few days' exposure at ordinary living-room temperature to restore the natural flavor of potatoes which have sweetened in storage.

Although the sugar content was higher in potatoes stored at 50° F. than at 60°, it apparently was not high enough to affect the quality.

In order to determine the influence of the length of curing on the

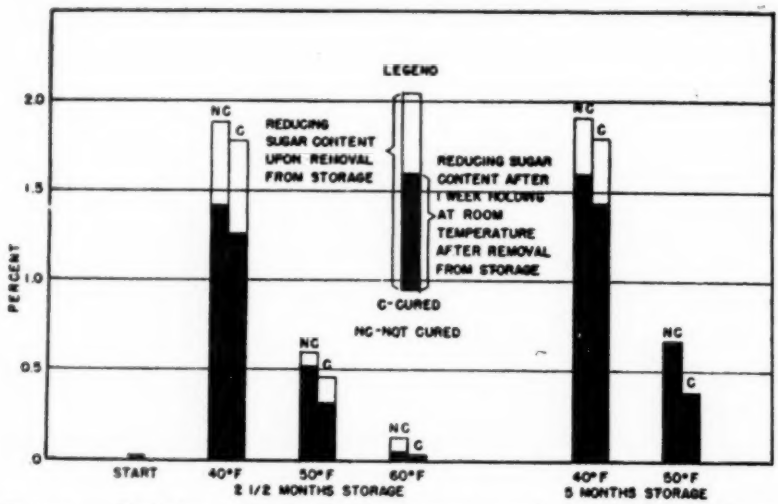

FIGURE 3.—Reducing sugar content of potatoes stored at various temperatures.

sugar content of potatoes stored at 40° F., the sugar content of potatoes cured in a shed for the periods indicated in table 5 was determined

TABLE 5.—*Influence of length of curing period on sugar content of potatoes stored 2½ months at 40° F. followed by a one-week holding period at room temperature.*

Length of Curing Period	Reducing Sugar	Total Sugar
Days	Per cent	Per cent
0	1.42	2.14
1	1.32	2.04
2	1.22	1.82
4	1.18	1.98
7	1.26	2.02
11	1.12	1.64
14	1.10	1.58

after 2½ months' storage plus one week at room temperature. In general, the reducing sugar content decreased with increase in length of curing period, from 1.42 per cent in the non-cured potatoes to 1.10 per cent in those cured 14 days prior to storage. The total sugar content showed a similar decrease, from 2.14 per cent to 1.58 per cent. When baked, the flavor of potatoes cured 11 and 14 days was quite satisfactory, being practically free from objectionable sweetness.

SUMMARY AND PRACTICAL APPLICATIONS

Storage of Irish potatoes under non-refrigerated conditions, such as in a shed or basement, resulted in very high losses. Spreading the

potatoes out in a single layer or covering them with hydrated lime did not improve their keeping quality.

For a storage period of 2½ months, potatoes kept in a satisfactory condition at 40° F. if they were cured before storing, or at 50° or 60° whether they had been cured or not. The potatoes stored at 60°, although in fairly good condition, had started to sprout and showed some shriveling and loss in color.

For a storage period of five months, only those potatoes stored at 50° F., either cured or not cured, or at 40° if cured, were satisfactory; but those stored at 50° were starting to sprout and were somewhat faded in color and shriveled.

Storage at 40° F. resulted in the development of considerable sweetness. There was less sweetness in potatoes that had been cured prior to storage, and still less after a one-week holding period at a room temperature of about 81° subsequent to removal from storage. As a result, cured potatoes stored at 40°, although still showing slight sweetness, were of acceptable quality when baked following a one-week holding period at room temperature after removal from storage.

Storage at 40° F. without curing resulted in a sinking and darkening of the skinned areas as a result of their failure to heal. This produced an undesirable appearance and considerable shrinkage, and predisposed these areas to decay after removal from storage. Curing at room temperatures of about 81° for four days or longer prior to storage practically eliminated this trouble.

For best results, if the storage period is to be two or three months or less, it is suggested that potatoes be stored at 50° F. immediately after harvesting. If this temperature is not available, either 60° or 40° would be suitable, but they should be cured four days or longer at 60° to 80° before storage at 40°. It is suggested that the curing period be made as short as possible, especially if the curing is done at room temperatures, because of the danger of decay at this relatively high temperature. For five months' storage, cured potatoes stored at 40° had the best keeping quality, although those stored immediately at 50° had fair keeping quality.

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DEVELOPMENTS IN POTATO BREEDING

Summaries of talks presented at the Potato Association of America meeting held at Chicago on December 2, 3, and 4, 1946.

The National Potato Breeding Program which got under way in 1929 has resulted in the introduction of many new varieties, quite a few of which already are in commercial production. Inasmuch as the program is expanding so rapidly we can no doubt look forward to increasing numbers of new introductions in the years ahead. Many problems are involved and the Program Committee arranged a number of topics for discussion represented by the following summaries. As a background for the various topics a brief historical resumé under the topic "Breeding New Varieties," setting forth some of the earlier attempts of originating potato varieties, the problems of testing and classifying them, the object of the National Potato Breeding Program, and the present status of potato varieties now in commercial production, was presented by the discussion leader.

The material presented gives a clear picture of some of the accomplishments attained and what is involved in originating a new variety and some of the methods used in properly testing before a new introduction is made.

Breeding New Varieties[1]

Probably the first attempt at potato breeding in the United States was made by Rev. C. E. Goodrich of Utica, N. Y., about 100 years ago. The ravages of late blight furnished the incentive. Although he did not attempt hand pollination, he did obtain the Garnet Chili, a seedling from one of the varieties that he secured from South America. The introduction of the Garnet Chili developed a widespread interest in potato breeding.

[1]Paper No. 2347 of Scientific Journal Series Minnesota Agricultural Experiment Station, St. Paul, Minnesota. A. G. Tolaas, University Farm, St. Paul 1, Minn.

Other breeders of that time were C. G. Pringle (Vermont), E. S. Brownell (Vermont), Alfred Reese (Early Ohio –from naturally fertilized seed ball of Early Rose 1870), Luther Burbank (Burbank 1873, seed ball Early Rose), E. L. Coy (Beauty of Hebron 1874—naturally fertilized seed ball of Garnet Chili). Of these men, Pringle was probably the most skillful, doing the actual crossing, selecting healthy plants of varieties for crossing with a definite purpose in view. He sold the seed obtained by hybridization to seedsmen and growers. This resulted in wide dissemination and production of many promising new varieties. Accordingly it is quite apparent that most, if not all, of the testing was done by growers.

Up to about 1900 there were probably over 1000 varieties named. This list contained many names that represented plants and tubers having the same characteristics, or in other words, the potato variety situation was in a state of confusion.

It remained for Wm. Stuart to bring order out of chaos as a result of extensive testing of varieties collected from all parts of the country. His bulletin entitled, "Group Classification and Varietal Descriptions of some American Potatoes," no doubt is familiar to all of you. The classification of varieties into groups was an important step toward a satisfactory and intelligent study of the varieties themselves. It was shortly after the publication of this bulletin in which Stuart classified American Potato Varieties into groups having similar characteristics, that Seed Potato Certification got under way. We all had the same variety problem to contend with and Stuart's classification was a most helpful guide to those of us who had the responsibility of seed potato certification. A survey made in our own state in 1915 revealed that potatoes were being grown under 70 different names. The first thing we did in our certification work was to recognize varieties under Stuart's group classification. This soon cleared up the confusion which existed at that time.

For a period of about 30 years from 1884 to 1915, most introductions were obtained from naturally fertilized seed or as mutations from varieties already under cultivation. Stuart developed the technique of breeding, and as a result of his careful methods, we have the Chippewa and Katahdin. The latter variety has served as a base for the development of many of the newer varieties under the present National Potato Breeding Program. Since the breeding program got under way, some 30 odd new varieties have been introduced. Some of these, together with the old standbys, have been included in an excellent bulletin by Clark and Lombard entitled, *"Description of and Key to American Potato Varieties."* Potato breeders engaged in the National Potato Breeding

Program have a definite procedure in introducing a new variety including origin, technical description, adaptability, culinary qualities, etc., which was not available for the many varieties included in Stuart's classification since so many persons are engaged in this new potato breeding program and since the introduction of new varieties is increasing rapidly, a revision of Clark and Lombard's bulletin about every five years would be highly desirable in order to keep us accurately informed of the progress that is being made, and it would have the additional advantage of containing the necessary information about the varieties introduced in one publication.

Since the *origination, development, testing* and *introduction* of new varieties involves many problems, the Program Committee thought it desirable to include in the program a few topics for discussion of some of the aspects of this important phase of our potato industry.

Before calling on the speakers, it might be of interest to glance at a chart which I have made which might give some idea of the varieties now in commercial production. As you will note, these figures are based on the total production in bushels certified and war approved for the year 1945. The column at the right shows production of the ten leading varieties grown in Minnesota.

VARIETY TRENDS BASED ON CERTIFIED SEED POTATO PRODUCTION IN 1945

Ten Leading Varieties

United States—Per cent of Total Production		Minnesota—Per cent of Total Production	
Irish Cobbler	30.5	Irish Cobbler	58.39
Bliss Triumph	18.2	Bliss Triumph	16.26
Katahdin	10.6	Pontiac	9.75
Russet Burbank	8.33	Red Warba	4.2
Green Mountain	8.03	Chippewa	3.35
White Rose	5.06	White Rose	2.18
Chippewa	4.09	Early Ohio	1.86
Pontiac	3.5	Katahdin	1.04
Sebago	2.09	Warba	0.65
Red McClure	2.1	Sebago	0.63
Other Varieties	7.5	Other Varieties	1.69

Total bushels certified and war approved—42,057,335

The percentage representing the ten leading varieties may not be 100 per cent correct, but since they represent most of the seed stock to be planted, I think that they do give a fairly accurate picture of the variety situation at the present time. In the line "Other varieties" are included

some of the old commercial varieties and many of the more recent introductions.

Recent Developments in Potato Breeding[2]

It was hoped that Dr. F. J. Stevenson could be with us to discuss the recent developments in potato breeding. I shall try to present a few salient facts concerning the scope of the potato breeding work, point out some of its accomplishments, call attention to some of the phases that are receiving major emphasis and give a few illustrations of the progress that is being made.

The National Potato Breeding Program was organized at Chicago in 1929. The primary objective was to promote and encourage potato breeding work in the United States by providing a means to facilitate the exchange of information and material. It was followed by a fairly rapid expansion of potato breeding. At the present time, work is in progress in 25 states, two territories, and by the U. S. Department of Agriculture. Since 1929, there have been at least 36 varieties named and introduced. The accompanying chart gives the names of these varieties and the approximate year of introduction. It will be noted that the new introductions which were relatively few at the beginning, have gradually increased in number to a relatively large number of introductions in 1945. The number introduced in successive five-year periods, since the introduction of the Katahdin in 1931, is given in table 2. During the first five-year period, 1931-1935, five were introduced, six in the second five-year period, 1936-1940, and twenty-two in the next five-year period, 1941-1945. These figures reflect the increased interest and activity in potato improvement by breeding which has occurred since the National Potato Breeding Program was initiated.

The new varieties cover a wider range of maturity than the older varieties. Within the group of new varieties are found desirable characters not present in the older varieties. These characters include greater uniformity in size, and shape, greater freedom from growth abnormalities, greater resistance to a number of the virus diseases, and high resistance to common scab and late blight.

In certain characters the new varieties are sometimes weaker than the older varieties. This is due to the fact that these varieties represent initial and incomplete stages in the progressive breeding steps leading to improved combinations of characters. I shall give a few illustrations.

Breeding for Resistance to Common Scab

The sources of resistance to common scab were varieties obtained from Germany such as Jubel, Hindenburg and Arnica. These are long

[2]F. A. Krantz, Division of Horticulture, University Farm, St. Paul, Minn.

NAME OF VARIETY AND APPROXIMATE YEAR OF INTRODUCTION

Variety	Approx. Year	Variety	Approx. Year
1 Katahdin	1931	19 Cayuga	1944
2 Chippewa	1932	20 Mason	1944
3 Warba	1934	21 Erie	1945
4 Golden	1934	22 Alamaine	1945
5 Houma	1935	23 Ashworth	1945
6 Pontiac	1936	24 Beach	1945
7 Mesaba	1938	25 Calrose	1945
8 Earlaine	1938	26 Chenango	1945
9 Sebago	1938	27 DeSota	1945
10 Red Warba	1939	28 Empire	1945
11 Sequoia	1939	29 Lake	1945
12 Norkota	1941	30 LaSalle	1945
13 Mohawk	1942	31 Placid	1945
14 Pawnee	1942	32 Teton	1945
15 Kasota	1943	33 Virgil	1945
16 Allegheny Moun.	1943	34 Marygold	1946
17 Potomac	1943	35 Seneca	1946
18 Menominee	1944	36 Ontario	1946

season varieties. The production of marketable tubers has apparently, whenever tested, been distinctly below that of the varieties commonly grown in the United States. The first step in breeding was to cross these German varieties with more adapted varieties and selections. Selections from these initial crosses were widely tested. Many of the best selections were found to rate high for resistance to scab. Some of these had a combination of characters which approached the requirements for commercial production. A few of these as the Menominee Ontario, Cayuga and Seneca have been named and introduced. These varieties and selections represented the completion of the first step in breeding for resistance to common scab. The next step was to cross these selections with each other and also with unrelated superior commercial types. Selections from this second round of crosses are in various stages of test at the present time. It is expected that some of these selections will be both resistant to scab and more satisfactory for commercial production than the selections from the initial crosses with the German varieties. This work is being done at a number of the State Experiment Stations and by the U. S. Department of Agriculture. The work has progressed to a point where increasing numbers of improved resistant varieties can be expected to be introduced.

BREEDING FOR RESISTANCE TO LATE BLIGHT

Resistant varieties appear to be one of the most promising means for the future control of late blight as well as common scab. The source

of late blight resistance has been *S. demissum,* a non-cultivated tuber bearing species of Solanum from Mexico and Central America. Another source of resistant material has been the W-races developed by Dr. K. O. Miller (Berlin, Dahlem). These W-races were developed from blight resistant material found in a collection of potatoes from Central and South America made by the U. S. Department of Agriculture.

Dr. Donald Reddick of Cornell University has led in the development of blight resistant varieties. Starting with selected strains of *S. demissum* and by crossing with the cultivated potato he has developed and introduced the resistant varieties Empire, Placid, Virgil, Chenango and Ashworth. The U. S. Department of Agriculture, starting with the W-races developed by Dr. Miller has developed resistant selections, some of which will probably be introduced in the immediate future. At the same time, Dr. Stevenson and his co-workers have found that resistance of tubers to rot caused by the late blight organism is closely associated with vine resistance. This information simplifies the work of testing for resistance, for less labor is involved in testing the resistance of tubers in the laboratory than that of testing the vines in the field. The breeding for late blight resistance has passed the experimental stage and we have reasonable assurance that resistant varieties suitable for commercial production will be developed.

Similar illustrations can be given for improvement in adaptability, market and culinary qualities. Each of these qualities consists of a large number of specific characters. The problem of the plant breeder is to develop a combination of these characters superior to the existing varieties. For example we have been breeding for an improved early variety. The major weakness of the leading early variety, the Irish Cobbler, is the difficulty of putting up an attractive market pack with this variety. The initial introductions in the early and midseason group such as Chippewa, Warba, Earlaine, Mesaba, Pontiac and Kasota, all had certain weaknesses in their combination of characters which has limited their usefulness. Selections are now being increased which more nearly approach the combination desired. The improvements over the Irish Cobbler are (1) uniform large size with fewer under size tubers, (2) shallow eyes, and (3) a smooth even surface irrespective of size. Work is in progress to combine these characters with resistance to common scab and late blight in an early variety.

It must be recognized that despite the progress that has been made potato breeding is still in its infancy. The potential possibilities for the improvement of the potato is indicated by the fact that Dr. Stevenson was able to cite published work on 21 characters. These 21 characters

are scattered among many varieties, with relatively few of them in any one individual. The plant breeder by controlled pollination, testing and selection is constantly developing individuals with a larger number of desirable characters. Sooner or later in this program, individuals are obtained, with a greater number of the desirable characters than that found in a commercial variety. These are introduced as new varieties in addition to serving as parental material in the continuing process of improvement. In fact, they are usually employed as parents for further improvement a number of years before they have been sufficiently tested to warrant introduction as a new variety. For example, Selections 47, 6, 35, 42 and 23 have been used for a number of years as a source of earliness rather than Cobbler, Triumph, Warba and Early Ohio.

Breeding for Blight Resistance[3]

Breeding for blight resistance, if successful, leads eventually to a whole series of new varieties, one to take the place of each standard variety. From the purely commercial aspect the new variety must, in addition to its proofness, equal or exceed the standard variety in the characters that make it a standard. Complete revelation of all the characteristics of a new variety can scarcely be determined in the small-scale trials of the experimenter but rather must await the extensive trials of large-scale production. Many new varieties will be produced but only a few are likely to stand the test of time. On the other hand, potatoes are produced so extensively on a non-commercial scale that many varieties of restricted adaptation will find a place in limited areas providing only that it is not necessary to control blight.

The following varieties are either immune or very highly resistant to the blight caused by *Phytophthora infestans*. Empire, Placid, Virgil, Chenango, Ashworth, Essex, Glenmeer, Harford, Cortland, Snowdrift. These exist only in extremely limited quantities but all will be increased in 1947 and eventually will be available generally through regular trade channels.

Given a parent carrying the genes for resistance or immunity to blight, the breeding program differs from any other potato-breeding program only in that the elimination factor, the parasite, must be reckoned with at all times. This organism, unlike some parasites, is not stable. Given the right vitamin, it can live and thrive on inert material in a test tube. Given the green leaf of a Cobbler potato it thrives and produces blight; given the green leaf of Empire it dies; but, given a senescent and yellowing leaf of Empire it produces a mild blight and

[3]Donald Reddick, Cornell University, Ithaca, N. Y.

during the process "acquires" the ability to attack a somewhat younger leaf; and, by repeated passage, it becomes virulent for the green leaves of Empire. How many of the varieties mentioned above will react in the same way is not yet known but several unnamed seedlings which have been tested have not reacted in this way. It appears, therefore, that some varieties of potatoes lose their resistance factor by senescence and that others do not.

These experiences relate to hybrids in the third or fourth backcross stage from *Solanum demissum* as female parent. This species has been used extensively by several breeders. Other species from central Mexico which are immune have not entered the program because the initial crosses have not yet been effected.

Problems Related to Introduction and Testing[4]

The acceleration of the National Potato Breeding Program resulting in increasingly large numbers of new introductions intensifies the problems related to introduction and testing. These is need for some agency to come into the picture to take over the increasing of stocks of seed of foundation seed quality of new varieties that are being intended for introduction or that have been introduced. If the industry expects the plant breeders to release any material quantity of potatoes of a new variety when it is introduced, the resources of the plant breeders, including time and funds, will be used up to a large extent on such work so that less will be available for the work of creating a new variety for which only the breeder is set up. It is suggested that the Seed Certification Services or the Seed Potato Growers' Associations might very well take over this aspect, working of course in conjunction with the plant breeders. If the plant breeder is to continue to produce improved varieties and at the same time be responsible for turning out foundation seed stock of the more advanced varieties, he either has to follow the alternative of cutting down on the other aspects of the program, or to turn out only a few bushels of foundation seed stock at a time. With this latter method there is grave danger of the contamination of much of the seed stock and also a great likelihood that the variety will be increased so slowly and haphazardly that commercial quantities will not be available to the industries for several years longer than will be necessary if a well equipped organization takes over the job.

The people who market potatoes should assume more responsibility in connection with the introduction of new varieties. Let me cite the Kasota variety in this connection. This variety has not come into use to the extent that it should because of the fact that dealers fear it does

[4]H. O. Werner, College of Agriculture, University of Nebraska, Lincoln, Nebr.

not have a sufficiently red color and that therefore they have marketed this variety as a Triumph and consequently have had some repercussions. If marketed under its own name and own merits, and with little effort the Kasota would undoubtedly find a place for itself.

Although dealers may feel that the important consideration is that of market quality rather than cooking quality, plant breeders have a responsibility in considering the intrinsic food value of potatoes. They should endeavor to see to it that the lines which they release have good culinary qualities and high food value, and these aspects should be stressed in introducing a new variety. I have in mind especially the desirability of potato varieties with high Vitamin C content and also having tubers of a high specific gravity.

Briefly, in Nebraska we propose the following plan: The Experiment Station will continue to assume the responsibility of the breeding program and conduct comprehensive tests at a number of places and that the Foundation Seed Division of the Nebraska Certified Potato Growers Cooperative will assume responsibilities for developing a stock of foundation seed of selections which warrant serious consideration for introduction. This does not necessarily mean however that all selections that are increased to a considerable extent will be disseminated if it appears undesirable to do so after the varieties have had further testing on a large scale.

Procedures in the Introduction of New Varieties[5]

Since 1932 approximately 40 new varieties of potatoes have been introduced through the efforts of the United States Department of Agriculture and about 30 cooperating state experiment stations. In most instances the new varieties have been superior in one or more respects to the old standard varieties. In fact some of the new varieties because of their disease resistance, satisfactory yield and good market quality have partly replaced some of the older varieties in certain states.

Based on the success of the potato breeding program thus far and on the skill and effort that is being put into this work there is good reason to believe that many more new and better varieties will be forthcoming in the next few years. However as the potato breeding progrm progresses in its quest for the perfect potato the problems involved in the introduction of new varieties become more complicated. The potato breeder is faced with the problem of raising his standards to insure the superiority of his newest variety over varieties that are not quite so new. The potato grower and the seed and table stock trade have the problem of determining the merits of the newest variety and deciding

[5]H. C. Moore, State College, East Lansing, Mich.

which varieties to discard. It is believed that the potato breeder, the grower and the trade can be helped materially in their "new variety" problems if a well organized or standard procedure is used in introducing a new potato variety.

In this discussion no attempt has been made to summarize the procedures used by the various states in introducing new varieties. Neither is it the intent to recommend procedures that would be applicable throughout the country. Each state has its own soil and climatic problems, insect and disease pests, etc. It is believed however that by outlining the work done in Michigan, that representatives here from other states will enter freely into the discussions. From their contributions no doubt some definite program of procedures can be worked out that will be of benefit to all concerned.

Only two varieties have been introduced from Michigan, the Pontiac and Menominee. The Pontiac was first grown in 1931 from true seed furnished by the U. S. Department of Agriculture. It was selected for further tests because of its vigorous plant growth, good yield and excellent tuber type. For four years it was tested with other seedlings and with standard varieties at the Lake City Experiment Station. The four years tests indicated that it had sufficient merit for over-state and out-of-state trials. In 1936 peck samples were placed with 14 Michigan growers in representative potato growing sections of the state. Ten tests were on upland soil and four on muck. Peck samples of the seedling were also tested in five other states. The results of the tests were generally satisfactory. Most of the growers favored the seedling for its quick emergence and good stand, high yield, good type and freedom from hollow heart. On muck soil it was outstanding in yield. Its tubers set deep so there was no sun burn injury. Further over-state and out-of-state trials were conducted in 1936, 1937, and 1938 with good results.

By 1936 it was believed that this seedling had sufficient merit to warrant putting it out as a new variety. Therefore arrangements were made to increase it under inspection so that a reasonable amount of certified seed would be available when it was finally released as a new variety. In Michigan the inspection and certification of seed potatoes is carried on by the Michigan Crop Improvement Association under the supervision of the Michigan State College. Several bushels of the seedling increased at the Lake City Experiment Station were placed with three certified seed growers—two in the lower peninsula and one in the upper peninsula. On the certified seed farms the seedling plots were isolated 200 yards or more from other potatoes and a portion of each

plot was planted in tuber units. Careful inspections and roguings were given the plots during the growing season. At harvest time hill and tuber unit selections were made for the next season's seed plots. Increases from the three certified seed farms amounted to approximately 2000 bushels in 1938. The name Pontiac was then given the seedling and it was released as a new variety.

The other Michigan release is the Menominee. This U.S.D.A. seedling 528-118 was obtained from Maine in 1938 with other scab resistant seedlings. Common scab is a serious problem in Michigan and many other states. In Michigan many growers can not produce a good marketable crop of potatoes due to severe scab infection of the soil. For the past ten years therefore special attention has been given to the breeding and testing of seedlings for scab resistance. The testing work has been carried on at the Upper Peninsula Experiment Station at Chatham, the Lake City Experiment Station and on a certified seed grower's farm at Rogers City. At each of these places the seedlings have been tested on soils heavily infested with scab. Practically no scab-free potatoes have been produced on these plots with scab susceptible varieties such as Chippewa, Pontiac, Rurals, etc. For three years seedling 528-118 was tested with other scab resistant seedlings and proved the most scab resistant of any with one exception. Seedling 528-194 was slightly better in scab resistance but in cooking tests its flesh was dark. In 1941 seedling 528-118 was placed in over-state trials on 30 farms in tests with Russet Rural, Chippewa and other standard varieties. The results of these tests showed that the seedling was worth considering for release as a new variety. Hill selections were made at the Rogers City farm for 1942 plantings and placed with two other certified growers. Field trials were continued in 1942 and 1943. Inspections and roguing were carried on at the three certified seed farms to insure a good supply of seed for distribution. Approximately 3000 bushels of certified seed were available in 1943 when the seedling was released for distribution as a new variety—Menominee.

Based on the experiences that we have had in Michigan in introducing new varieties the following suggested procedures might be made for our introduction of new varieties in the future. It may be that some of these suggestions will be applicable for other states.

1. When a seedling selection shows promise of becoming a new variety, increase it to 20 bushels or more in isolated plots under close supervision.

2. Test its adaptability to various soil and climatic conditions by placing one-half bushel or larger samples of it with a few selected growers in representative potato growing sections of the state.

3. Make two or more inspections of each grower's plot during the growing season to study disease and insect resistance, character of growth, adaptability, etc.

4. At harvest time obtain records of yield, type, freedom from disease, etc. Procure samples for storage and cooking tests.

5. If the first year's over-state tests are satisfactory continue them the second and third year on a larger scale.

6. If the seedling selection shows promise of becoming a new variety after one or two years of over-state tests, start two or more certified seed growers in its production. Each certified grower selected should be furnished with 10 bushels or more of the best seed available.

7. On the certified seed farms, plant the selected seed in isolated tuber-unit plots. Supervise the roguing, harvesting and storing. Make hill or tuber-unit selections for the next year's seed plot.

8. Give the seedling a variety name and release it for distribution when assured of its merit and when there are several hundred bushels of it available for distribution.

9. Govern the distribution of the new variety the first year through a Crop Improvement Association or other official state organization.

10. Publish in the American Potato Journal an article giving a technical description of the new variety: its adaptability, disease resistance, special cultural requirements, etc.

STEAM STERILIZATION TO KILL POTATO RING-ROT BACTERIA ON BURLAP BAGS

G. H. Starr

Wyoming Agricultural Experiment Station, Laramie, Wyo.

Burlap bags when contaminated with ring-rot bacteria, serve as a means of spread of the ring-rot disease from one lot of potatoes to another. Steam sterilization has been recommended as a method to be used in this phase of ring-rot control.

Tests were devised during 1945 and continued in 1946 to determine how much sterilization was necessary to rid burlap bags of the causal bacteria.

Methods Used

In this study two quantities of bags were used,—one with 10-bag lots, put loosely in the autoclave and the other with 40-bag lots wrapped tightly with wire at each end of the bale. Previous to sterilization, a piece of burlap 6 inches square, contaminated with ring-rot bacteria,

H. C. Moore, State College, East Lansing, Mich.

was placed in the center of each roll of bags. Immediately after sterilization, the roll of bags was removed from the autoclave and the contaminated burlap square was taken from the interior and tested for viability of the ring-rot organism. This was accomplished by rubbing freshly-cut surfaces of 10 Bliss Triumph tubers over the burlap to pick up the bacteria. These seed pieces were later planted and the subsequent plants inspected several times during the growing season for disease symptoms.

In 1945 the following tests were conducted in duplicate: 10-bag lots at both 5 and 10 pounds pressure for periods of 5 and 10 minutes; 40-bag lots at both 5 and 10 pounds pressure for periods of 5, 10, 20 and 30 minutes. In 1946 the tests were similar except that the treatment periods were longer, the maximum being 45 minutes.

Results Obtained

In 1945 some of the treatment periods were too short to obtain the desired control. Thus, in 1946 some were omitted and a few longer treatments added. The accompanying table (1) shows the results for both years.

Table 1.—*Efficiency of steam sterilization for burlap bags as shown by the amount of ring rot resulting from the various tests conducted at 5 or 10 pounds pressure for periods of 5 to 45 minutes.*

Burlap Bags, Pressure and Time of Sterilization			Per Cent Ring Rot (Gram-stain)	
No. of Bags	Pounds Pressure	Minutes	1945	1946
10	5	5	45	—*
10	5	10	25	10
10	5	20	—*	5
10	5	30	—	0
10	5	45	—	0
10	10	5	50	—
10	10	10	45	15
10	10	20	—	0
10	10	30	—	0
10	10	45	—	0
40	5	5	35	—
40	5	10	55	45
40	5	20	20	15
40	5	30	0	0
40	5	45	—	0
40	10	5	50	—
40	10	10	55	40
40	10	20	—	0
40	10	30	0	0
40	10	45	—	0

*Tests not made that year.

Table 1 shows that when 10 bags were autoclaved at 5 pounds pressure, a period of 20 to 30 minutes was necessary for complete sterilization, whereas at 10 pounds a 20-minute period was sufficient. When 40 tightly-rolled bags were treated similarly, a 30-minute period was necessary at 5 pounds and a 20-minute period necessary at 10 pounds for complete sterilization.

Summary

Tests were made in 1945 and 1946 to determine how much sterilization was necessary to rid burlap bags, 100-pound size, of ring-rot bacteria.

Both 10 and 40-bag lots were tested at 5 and 10-pound pressures for periods from 5 to 45 minutes. In each case a contaminated burlap cloth was placed inside each roll and after sterilization it was used to inoculate cut surfaces of Bliss Triumph potatoes. These were planted later in field plots and the subsequent plants observed for ring rot.

The results indicated that the minimum requirements for thorough sterilization of 10 and 40-sack lots are as follows:

10 bags (loosely rolled) at 5 pounds pressure—20-30 minutes.
10 bags (loosely rolled) at 10 pounds pressure—20 minutes.
40 bags (tightly rolled) at 5 pounds pressure—30 minutes.
40 bags (tightly rolled) at 10 pounds pressure—20 minutes.

SECTIONAL NOTES

ALABAMA

Harvesting of the commercial potato crop was finished about the 10th of June. Final shipments, as had been forecast earlier in the season, amounted to about 3,000 cars. This was 65 per cent of a normal crop for the acreages planted.

The price for U. S. No. 1 grade averaged well above the floor price most of the shipping season. On the other hand No. 1B size would not sell. This resulted in the government support program, which received national publicity due to the dumping of some B size potatoes. Our growers, although not desiring to see waste, recall that a few years ago the OPA forced them to sell an entire crop for $2.00 per hundred less than could have been secured on the open market without control.

As usual a certain per cent of our growers failed to make an adequate return on their investment and labor; whereas others realized a satisfactory return. It seems that growers were better pleased with the Triumph variety, however the Sebago can be expected to hold its own

another season. Dusting and spraying proved to give satisfactory control of late blight according to observing growers. (July 9)—FRANK E. GARRETT.

CALIFORNIA

As of the 24th of June, 28,029 cars of potatoes have been shipped from the Kern district. Of this amount, 26,343 were from Kern County alone. This made 4,728 cars more than were shipped at this date last year. The peak day was the 28th of May with 956 cars loaded and shipped. The quality of the crop, on the average, is above last year. The yield per acre shows promises of being the highest in any year since the beginning of the industry. Our harvesting period, as a whole, is well past the peak, with many areas entirely completed.

One interesting fact, from the production and marketing reports, shows that to date 17,129 cars have been shipped from all other potato sections whereas 26,343 cars were loaded and shipped from Kern County alone.

Car shortage has curtailed digging and shipping for the past ten days, but is expected to improve in the near future.

The selling price declined gradually from the opening of $3.50 per 100 pounds, however, the price increased again to $3.25 which is our present selling price. (June 27).—ROY M. BARNES.

COLORADO

Potato prospects in the San Luis Valley, better known as the Red McClure district, are very good. Growers finished planting early in June with the bulk of the acreage being planted in May. There was little rain at the beginning; however, by planting time soil moisture was very good.

Many plants had emerged in time to be frozen to the ground on the 19th of June. Later plantings that were not frozen are now ahead of some of the earlier plantings that were retarded in growth by the frost. The light showers and cool temperatures during the latter part of June and the first few days of July have been very favorable for potatoes. (July 7).—W. FRANK MCGEE.

FLORIDA

The 1947 potato season at Hastings was one of the coldest, wettest and most unprofitable on record. The low temperatures on the 5th, 6th, 9th, 10th and 11th of February killed the tops of all our early-planted crops. About one-fourth of the acreage was seriously injured by the low temperatures. Approximately 1,000 acres in which 10 per cent or less

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of the plants recovered were plowed up and replanted to potatoes and other crops.

Heavy rains which totaled 6 to 8 inches in several localities during a 6-day period (April 12-17) 2 to 5 weeks before the crops were ready for digging caused extensive damage. About 500 acres in one locality where 5.4 inches of rain fell within a 2-hour period were ruined completely. A 50 per cent reduction in yield on at least 5,000 acres was caused by the deluge. Only approximately 1,000 acres of the 10,000 planted escaped damage from freezes, excessive water and soft rot. (July 7).—A. H. EDDINS.

INDIANA

With the exception of the very last of June, the weather handicapped our potato growers to so great an extent that the acreage this year will be somewhat less than anticipated. Those, however, who have potatoes planted have good stands, very little leafhopper or flea beetle, and very little blight.

This week I visited our commission house in Lafayette and observed a lot of poor quality potatoes from the Western States and also from the South. Some one is paying a lot of freight on cull potatoes, but I suppose the shippers are of the opinion—like most everyone else—that "anything will sell these days." (July 3).—W. B. WARD.

MAINE

This season our growers are two weeks late with their potato crop. Many farmers were unable to get a full day's planting until the very last of the season, because of showers. Seldom has any one seen so much bare soil the first of July.

Aroostook County had an allotment of 170,000 of the state's 185,000-acre total. It is estimated that 95 per cent of the farmers are staying within their allotment and since most are playing safe, the total acreage for the county and state is estimated to be from 1 to 5 per cent under the allotment.

Four meetings of former leaders were recently held with Floyd Hedlund, of the Fruit and Vegetable Division, who led the discussion on marketing agreements. In view of the price situation however, no one seems to be particularly excited about marketing agreements at present. There is little opposition also. Whether much will be done toward marketing agreements for the 1947 crop remains a question.

E. L. Newdick, Chief of Plant Industry, announced that 65,449 acres have been entered for certification. This is about 12,000 acres less than were entered last year. Katahdins account for 33,760 acres; Cob-

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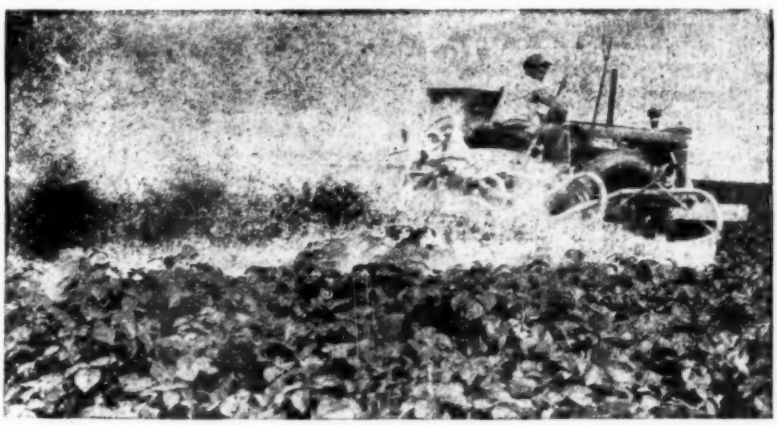

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blers dropped from 17,300 acres to 10,862; Green Mountains from 11,100 to about 8,918; Chippewas increased to 8,320 from 6,685; and Sebagos dropped from 4,525 to 2,549 acres.

Many farmers are using DDT for the control of flea beetles, and indications are that practically all farmers will use DDT every time they use fungicides. Potato waste piles, which are usually a source of late blight infection, are being cleaned up. (July 3).—VERNE C. BEVERLY.

MICHIGAN

Michigan, like many other areas was somewhat delayed in getting the crop planted. The weather has been very favorable since planting. Stands are generally good. Some of the late plantings are just breaking through the ground.

The acreage of certified seed will be 10 to 15 per cent below last year. The largest part of Michigan's Seed acreage is Russet Rurals. This variety will comprise most of the reduction in acreage, whereas Katahdins will show some increase. Table stock acreage will be reduced with a very noticeable reduction with small growers.

There is considerable interest in irrigation and a number of new irrigation projects have been set up. Most growers are using lakes, rivers, or ponds, as a source of water but a few have drilled wells. These are mostly 10-inch and are capable of supplying enough water for the irrigation of 75-100 acres with approximately 1 inch a week. (July 8.)—H. A. REILEY.

MISSOURI

Digging of the Missouri commercial potato crop began on the 8th of July and with favorable weather the bulk of the harvest will be completed by the 26th. It is really too soon to give a very accurate estimate regarding yields per acre. However, on the whole, the season has been none too favorable and the yields per acre are not expected to be as good as in 1946.

Floods, back water and excessive rains during June destroyed approximately 50 per cent of the potato acreage in Jackson, in Ray and Clay counties. The growers in these counties planted approximately 2,300 acres and the present estimate is that they will harvest about 1,200 acres. The acreage lost by the floods was in the Courtney and Atherton bottoms. This area generally produces the highest acre yields, whereas some of the remaining acreages, not destroyed by the floods, represent later plantings which are not expected to yield heavily. (July 14).—ALLAN W. PURDY.

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NEW JERSEY

New Jersey growers have started to harvest their Cobblers although the vines are for the most part still green. Yields have been fair to good. General harvesting and car-lot shipments will start shortly after the 21st of July, with rather heavy movement in prospect about the 1st of August.

Most potato sections have had sufficient rainfall for good plant growth to date and the prospects for a good yield are general.

Our growers have been urged to grade their potatoes with a 2" minimum and many growers are planning to do this in order to improve the pack.

With orderly harvesting and shipping our growers should enjoy a good market during August and September with little need for government support. (July 17).—J. C. CAMPBELL.

NEW YORK

This is the first time in many years that any appreciable acreage of potatoes has been planted after the 1st of July.

Some fields that were planted early show a very uneven stand and in some areas excessive moisture has caused much seed piece rot. Because of the lateness of the season and the high price of table stock, considerable seed was sold for table stock in April and May. These factors, coupled with a late spring and a labor shortage, will give a net result of considerably less acreage than last year for the up-state territory.

Our crop prospects are not so good, because past experience indicates that late planting and poor stands usually result in a light crop. Potatoes do not seem to have the root system that they should have at this season of the year.

To date we have heard of no blight in this general area but it has been reported on two sides of us. It is only a matter of time before we can expect a general outbreak.

Although much thought and attention are being given to proposed marketing agreements there seems to be very little actual interest on the part of the grower. There is considerable interest however in putting up a better pack and following better merchandising methods on the part of some of our volume growers and associations. (July 8).—H. J. EVANS.

NORTH DAKOTA

The condition of our North Dakota potato fields varies from good to excellent. All variations caused by heavy rains and late plantings are being overcome during a season of good growing temperatures and ample

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moisture. With the late June rainfall, ranging from 2 to 6 inches throughout the area of commercial production, our topsoil moisture is good and the subsoil moisture, in general, very good. The acreage is about 10 per cent below that of 1946.

Further improvement of the quality of table stock crop and safeguarding of the quality of certified seed are receiving widespread attention. The following regulation of the State Seed Department has been well received and is resulting in an increase in the number of farmers who grow "nothing but certified."

"To be eligible for official field inspection and certification, all seed potatoes used on a farm or the farm-unit or with which the same planting and harvesting equipment and supplies were used must have passed field inspection requirements the previous year." (July 8).—HAROLD MATTSON.

PENNSYLVANIA

Late blight was found on potatoes on the 2nd of July in Pennsylvania and by the 10th of July was present in at least six counties. In one instance it had spread from potatoes to tomatoes and was causing serious damage on both crops. The disease is starting early this year and growers are experiencing difficulty in getting sprayers through the fields because of the excessively wet weather that has prevailed in Pennsylvania this year. (July 12).—O. D. BURKE.

SOUTH DAKOTA

Field inspection work is being conducted in the certified potato fields in South Dakota. The head field inspector, David Giese, reports exceptionally clean fields free from disease. The acreage entered for certification will total approximately 7,000 acres,—about the same as 1946. Bliss Triumphs comprise the bulk of the acreage although many Cobblers, Pontiacs and Red Warbas have been planted this year.

A hearing on a proposed marketing agreement for South Dakota was held in Watertown on the 19th and 20th of June. A referendum will be held soon to vote on the proposition. Growers are enthusiastic over the prospect of a favorable season this year but they do not anticipate the record yields presented last year because of the lateness of the season. (July 9).—JOHN NOONAN.

UTAH

The potato crop looks good in all the principal potato-growing areas. This is due largely to the cool, moist weather that prevailed during May and June. Harvesting of the early crop was begun in Weber County

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Last year, DDT definitely proved itself as an effective agent for controlling infestations of the Colorado Potato Beetle, Potato Flea Beetle and Potato Aphid. Tests conducted at Federal and State Experiment Stations, as well as actual crop figures, indicated an average potato yield increase of *25 barrels per acre* through control of these insect pests.

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PENCO

on the 25th of June and will continue throughout July and most of August.

The 1947 acreage is estimated to be about 6,150 acres of commercial stock and nearly 1,200 acres of seed. All potato-producing areas in the state, except Iron County, have reduced their acreage from 10 to 20 per cent. In contrast with Iron County, Cache Valley planted only approximately 325 acres of their 762-acre allotment.

The bulk of the acreage is devoted to the Bliss Triumph, Netted Gem and White Rose varieties. In Box Elder and Weber Counties there is also an appreciable acreage of Irish Cobbler, Katahdin and Pontiac varieties. There is an increased acreage of Pontiacs this year, supplanting Bliss Triumph and Cobbler. The growers report that the Pontiacs appear to be less perishable than the Cobbler and their eating quality surpasses that of the Bliss Triumph.

The acreage of certified seed is slightly less than in 1946. Applications for 1,182 acres have been filed, as compared with 1,213 acres certified in 1946. The acreage of White Rose is nearly 13 per cent higher than last year, whereas that of Netted Gem is about 10 per cent lower, with Bliss Triumph approximately 30 per cent lower than 1946.

The unusual occurrence of leaf roll in the Utah foundation seed stocks of the Bliss Triumph variety in recent years has necessitated the initiation of research in improved methods of indexing and propagating foundation stocks. (July 1).—E. L. Waldee.

VIRGINIA

The potato crop is being harvested about two weeks later than usual this year. The crop was delayed by dry weather during May and June. The general yield will be somewhat below normal and serious reductions will be experienced in some parts of the Eastern Shore area.

Late blight was of no importance in 1947. None was found on the Eastern Shore and only a trace was found in the Norfolk area. Black leg was more prevalent than usual and is causing some rot in the field and in transit. The potatoes are generally of good quality, but some rot is developing in transit as a result of sun scald. (July 9).—Harold T. Cook.

MEETINGS OF INTEREST TO POTATO GROWERS

August 7—Richford, New York. Annual field day of the Empire State Potato Club on the Clark Seed Farms. There will be demonstrations of mechanical stone pickers, new types of

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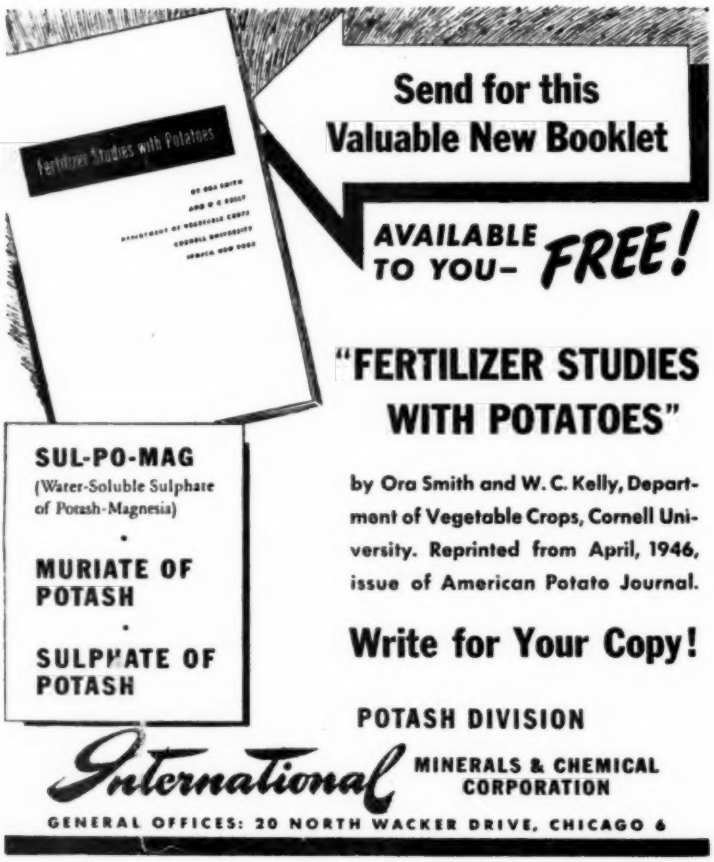
August 12—Monte Vista, Colorado. Eighth annual field day at the San Luis Valley Demonstration and Experimental Farm.

August 15-16—Monte Vista, Colorado. The High Plains Potato Conference will be held at the El Monte Hotel. The first day will be devoted to a discussion of potato problems. A field trip and various demonstrations have been arranged for the second day, followed by a picnic. Reservations may be made direct to the El Monte Hotel, El Campo Tourist Court, or the Triangle Cottage Camp.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For Flea Beetles, Leaf Hoppers and Colorado Potato Beetles – use 1 pint of Syndeet-30 per 100 gallons of water. Apply at the rate of 100-150 gallons per acre.

For Aphids and other potato insects – use 1 pint of Syndeet-30 per 100 gallons per acre if infestation is light. Use 1 quart per 100 gallons if infestation is heavy, and apply at 130-150 gallons per acre.

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Valuable as this method of diagnosis has proven, it has its limitations owing to inter-relationships of nutrients in the plant and to other factors that might cause abnormalities. Recently it has been observed that when an application of a nutrient has not produced the expected results, a hardpan of impermeable layer in the soil may offer an explanation. Restricted root zone, reduction of capillary action, and limited quantities of oxygen lessen a plant's ability to absorb nutrients that might be in the soil and available if the hardpan were eliminated.

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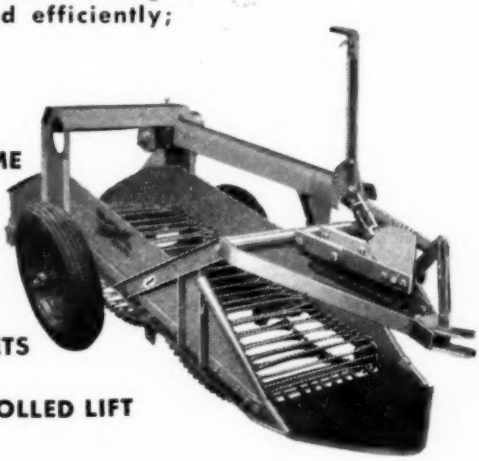

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